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H984-F

Cap. 8

# MARKETING

# Eggs

SEPTEMBER 16

## U. S. EXTRAS

Large - - - 29¢  
Medium - - 26¢  
Small - - - 22¢

## U.S. STANDARDS

Large - - - 25¢  
Medium - - 22¢  
Small - - - 20¢

U.S. TRADES - 20¢

*Farmers'  
Bulletin*

No. 1378 rev.

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U. S. DEPARTMENT  
OF AGRICULTURE



## THE EGG

**Q**UALITY is the most important factor in market value.

A good market egg requires—

Good production methods on the farm.

Good handling methods during its journey to market.

Speed in movement from the nest to the consumer.

The best method of marketing for each producer depends upon—

Volume of egg production.

Proximity to consuming centers.

Shipping facilities.

Cost of transportation service.

Available buying or marketing agencies.

Time and labor costs of preparation and delivery.

# MARKETING EGGS

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**E**GGs ARE PRODUCED on almost 6 million farms in the United States, including a large majority of the farms in each State. On most of these farms, egg production is a side line. The surplus available for market from each farm is small, but the total surplus of the farms, taken together, is sufficient to supply the needs of an urban population of about 80 million people.

Chicken eggs produced on farms in the United States in 1939, according to estimates of the United States Department of Agriculture, numbered 3,185,416,000 dozen. These had a total sales and home-consumption value of \$538,618,000.

## WHERE EGGS ARE PRODUCED

Specialized poultry farms, on which the production of market eggs or poultry is the chief activity, are much less numerous than the farms with general farm flocks. According to the 1935 census nearly 57 percent of the farms reporting the number of chicken eggs produced had flocks of less than 50; they produced only 17 percent of the eggs. Approximately 23 percent had flocks numbering from 50 to 99 and produced 20 percent of the eggs; about 14 percent had flocks ranging from 100 to 199 and produced about 26 percent of the eggs; and about 4½ percent had flocks ranging from 200 to 399 and produced 18 percent of the eggs reported. Of the total number of farms reporting, more than 98 percent had flocks containing less than 400 chickens and produced about 82 percent of the eggs. On the other hand, only ½ of 1 percent of the farms had flocks of 1,000 or more, but produced nearly 8 percent of the eggs (table 1.)

TABLE 1.—*Chicken eggs: Percentages produced in 1934 on farms in the United States by size of flock*

[1935 United States Census of Agriculture]

Size of flock	Farms reporting	Percent of total farms reporting	Percent of total eggs
	<i>Number</i>	<i>Percent</i>	<i>Percent</i>
None kept.....	26,352	0.47	0.37
Under 50.....	3,178,603	56.97	17.05
50 to 99.....	1,269,008	22.75	20.00
100 to 199.....	788,880	14.14	26.43
200 to 399.....	253,853	4.55	18.23
400 to 699.....	41,860	.75	7.14
700 to 999.....	9,647	.17	3.00
1,000 to 2,499.....	9,517	.17	5.35
2,500 and over.....	1,479	.03	2.43
Total.....	5,579,199	100.00	100.00

Specialized egg farms are located in greatest numbers along the Atlantic coast in proximity to the great consuming centers and along

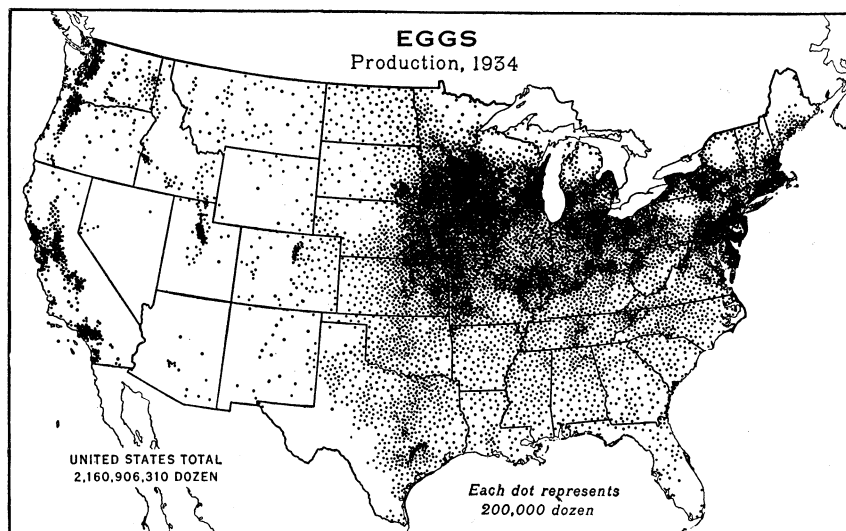


FIGURE 1.—Egg production is widely distributed, and commercial receipts originate in many States.

the Pacific coast where climatic conditions are especially favorable for egg production. They are found in smaller numbers close to large cities in other sections and scattered generally throughout the United States. Because such specialized farms are fewer, their total egg production is much less than that of the general farms (fig. 1).

Although the areas of intensive egg production are located in the East and on the Pacific coast, the greatest supply of eggs is produced in the eastern North Central and the western North Central States. According to estimates of the Department of Agriculture for 1939, Iowa led, with an annual production of 215,417,000 dozen and was

followed in order by Ohio, Texas, Pennsylvania, Illinois, Missouri, Minnesota, Wisconsin, New York, and California. Not only do the North Central States produce the most eggs, but because of a smaller urban population they have a greater surplus for shipment to eastern and other large consuming markets. Table 2 and figure 2 indicate the importance of each State and section of the country as a surplus producer of eggs.

TABLE 2.—*Eggs: Receipts at five markets, by States, 1939*

State of origin	New York	Chicago	Philadel- phia	Boston	San Fran- cisco	Total
	<i>Cases</i>	<i>Cases</i>	<i>Cases</i>	<i>Cases</i>	<i>Cases</i>	<i>Cases</i>
Alabama.....	56	2				58
Arkansas.....		201		834		1,035
California.....	52,897	4,375	17,563	3,600	833,629	912,064
Connecticut.....	6,563			3,125		9,688
Colorado.....		10,500			396	10,896
Delaware.....	21,665		14,294	2		35,961
Florida.....	383					383
Georgia.....	321					321
Idaho.....	37,510		1,172		336	39,018
Illinois.....	325,362	544,453	105,259	109,973		1,085,047
Indiana.....	367,493	92,004	28,035	37,452		524,984
Iowa.....	1,488,127	1,539,597	132,778	329,723		3,490,225
Kansas.....	143,800	86,108	33,897	44,834	3,636	312,275
Kentucky.....	2,077	7,118	3,766	264		13,225
Maine.....	1			119,864		119,865
Maryland.....	50,572		60,227	15		110,814
Massachusetts.....	4,757		600	116,994		122,351
Michigan.....	28,019	13,597	4,388	16,523		62,527
Minnesota.....	821,851	851,265	231,453	55,744		1,960,313
Mississippi.....	778	509,513	400	7		510,698
Missouri.....	131,964		33,413	55,157	2,320	222,854
Montana.....		273				273
Nevada.....					1	1
Nebraska.....	84,036	409,291	31,923	20,429	7,515	553,194
New Hampshire.....	3,045			108,868		111,913
New Jersey.....	231,181		34,581	402		266,164
New York.....	883,192		6,949	19,205		909,346
North Carolina.....	403		4,065	3		4,471
North Dakota.....	8,484	22,270	5,621	4,047		40,422
Ohio.....	182,423	1,805	33,954	12,234		230,416
Oklahoma.....	1,213	3,969	651	19		5,852
Oregon.....	54,725	6,000	10,437	4,200	5,508	80,870
Pennsylvania.....	527,702		255,376	155		783,233
Rhode Island.....	1,880			628		2,508
South Carolina.....	40					40
South Dakota.....	49,449	239,056	17,324	18,836	456	325,121
Tennessee.....	20,565	3,524	9,122			33,151
Texas.....	1,400		98		5,833	7,331
Utah.....	253,770	12,648	4,800		3,630	275,448
Vermont.....	1,932			25,199		27,131
Virginia.....	79,294		21,651			100,945
Washington.....	374,077	6,861	24,988	7,460	2,701	416,087
West Virginia.....	1,200		4,715			5,915
Wisconsin.....	107,469	721,051	13,793	7,700		850,013
Wyoming.....		14	400			414
Parcel post.....	2,402	1,557	890	231		5,080
District of Columbia.....	9,159		157			9,316
Total.....	6,363,177	5,087,052	1,148,740	1,124,327	865,961	14,589,257

The smaller cities obtain most of their eggs from the producing territory immediately surrounding them, but the larger cities must draw much of their supply from more remote producing sections. The larger the city and the more extensive the suburban population, the greater becomes the problem of obtaining an adequate supply and the greater the necessity for obtaining a part of it from considerable distances (fig. 3).

Many of the surplus eggs produced in the States of New York, New Jersey, and Pennsylvania are sent to New York City and other

nearby consuming markets, but the quantity shipped to New York from these States in 1939 was only about 25 percent of the total supply

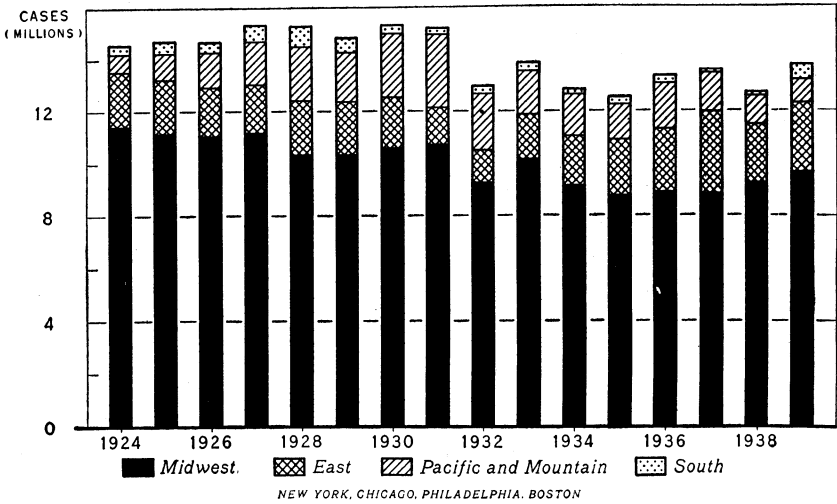


FIGURE 2.—Egg receipts at New York, Chicago, Boston, and Philadelphia, by region of origin.

received in that market. More than 57 percent came from the North Central States; <sup>1</sup> 8 percent from California, Oregon, and Washington;

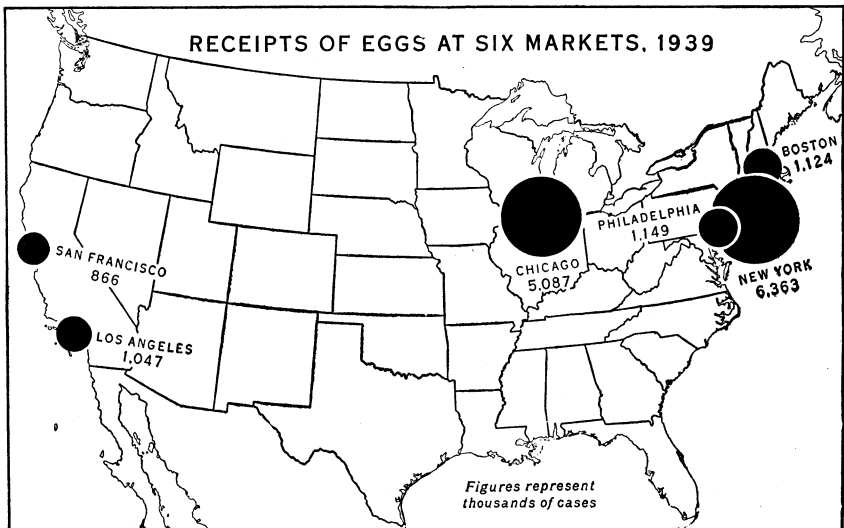


FIGURE 3.—Receipts of eggs at the principal markets give some indication of the leading centers of consumption.

about 4½ percent from Colorado, Idaho, and Utah; and a much smaller percentage came from the Southern States.

<sup>1</sup> Ohio, Indiana, Illinois, Wisconsin, Michigan, Minnesota, Iowa, Kansas, North Dakota, South Dakota, Nebraska, Missouri.

### THE PROBLEM OF TRANSPORTATION

When eggs are produced by small flocks in sections located a long distance from market, it is necessary that they be assembled and packed properly in large lots for economical handling and shipment. Thus the business of the egg buyer and shipper has become necessary.

The egg is an extremely perishable food product. Under unfavorable conditions it deteriorates rapidly. Shipments to the large eastern markets from the Middle Western States, where the greatest number of eggs are produced, must travel an average of 1,000 miles or more. This indicates the need for refrigerator cars or refrigerated trucks and suggests the general scope and complexity of the transportation problems involved. The Interstate Commerce Commission reported that in 1938 more than 28,658 cars of frozen, liquid, and shell eggs originated on Class I railroads of the United States. In recent years there has been a growing tendency to utilize trucks for the shipment of eggs for both short and long distances.

### SEASONAL PRODUCTION

If eggs were produced at a uniform rate throughout the entire year, the supply would be uniform and continuous and the problem of mar-

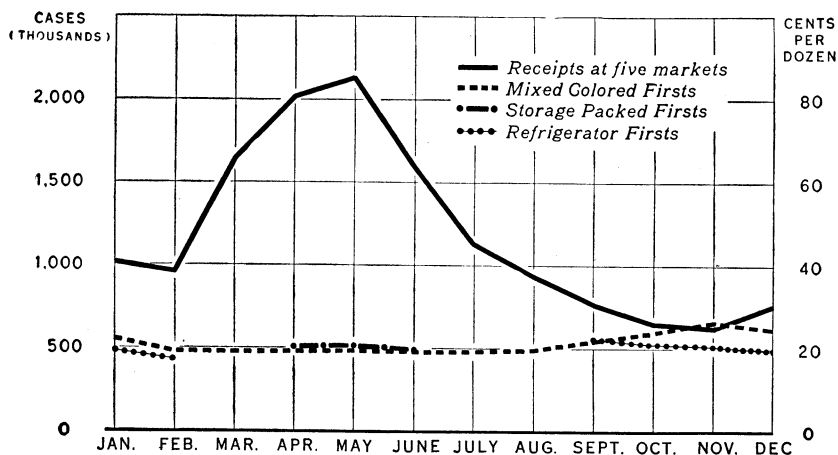


FIGURE 4.—Wholesale prices of eggs at New York and receipts at five markets average, January 1937–December 1939. The price of eggs rises as receipts decrease and falls as receipts increase. Storage-packed eggs bring a slightly higher price because of the better packing. The price of refrigerator eggs is normally below the price of fresh eggs.

keting much simplified. But the production is relatively high during the spring and early summer months, during which about 60 percent of the total crop is produced, and gradually declines during the fall, until it reaches its low point in November. This is well illustrated in figure 4 by the receipts of eggs at the five markets.

### THE FUNCTION OF COLD STORAGE

The uneven seasonal production results in a surplus during the spring season and a scarcity during the fall. It is one of the functions of the



wholesale egg trade to equalize the supply and to meet the demand at all seasons as nearly as possible. This is accomplished by moving part of the spring eggs through the usual channels for immediate consumption while the rest are carefully candled, packed, and placed in cold storage, where they are held until the late summer and fall months when there is a shortage of fresh eggs. Eggs specially packed for storage in new cases and with new fillers and flats are called "storage-packed" and sell for slightly higher prices than do similar eggs packed in other ways.

A part of the spring production of eggs is stored in a frozen condition, after being broken out of the shells. The storage of eggs in this form has increased rapidly in recent years, and the peak holdings now amount to approximately 145 million pounds. Such eggs are used almost exclusively in the manufacture of food products and are not sold directly to consumers as such. A much smaller quantity of eggs

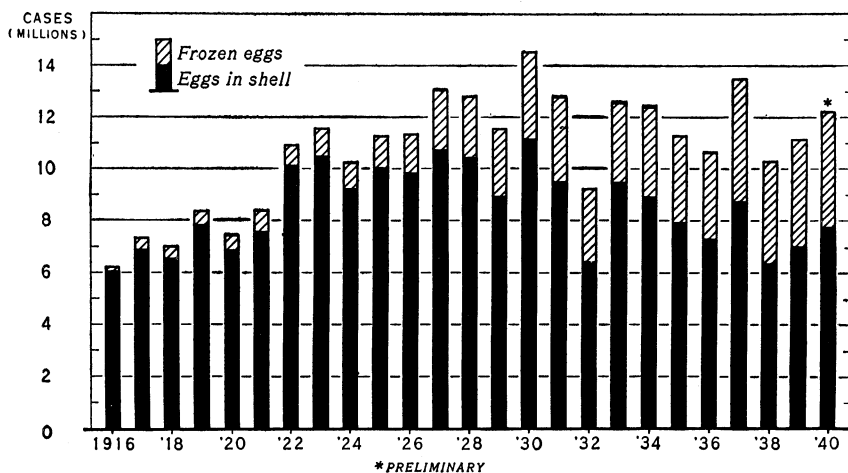


FIGURE 5.—United States cold-storage stocks of eggs on August 1, 1916–40.

produced in the spring are broken out of the shell and dried. These eggs are likewise held for later use and are used as constituents of manufactured food products or as ingredients of certain products such as prepared pancake or doughnut flour.

Approximately 12 to 15 percent of the total annual production of eggs is stored either as shell eggs or frozen eggs. Because greater egg production in the fall and winter months has been brought about by changing the dates of hatching, breeding, and management, it is no longer necessary to store in the shell as large a percentage of the annual crop as in the past. The use of frozen eggs, however, has grown rapidly, and the increases in the quantity stored have largely offset the decreases in the number of shell eggs stored.

The storage of shell eggs and frozen eggs usually begins in March, is increased during April and May, and continues at a lessened rate during June and July. The peak of storage holdings is usually reached by August 1 (fig. 5). Withdrawal of eggs from storage is light in August, but gradually increases in September and October, and is generally heaviest in November and December. Under present

conditions it is desirable to have storage stocks of shell eggs pretty well exhausted by January 1, although normally there are limited stocks that are carried beyond that date and disposed of in January and February. Cold-storage stocks of shell eggs are practically exhausted by March 1 or earlier each year (fig. 6).

Reports on the cold-storage holdings of eggs for the United States as the first of each month are released about the twelfth of the follow-

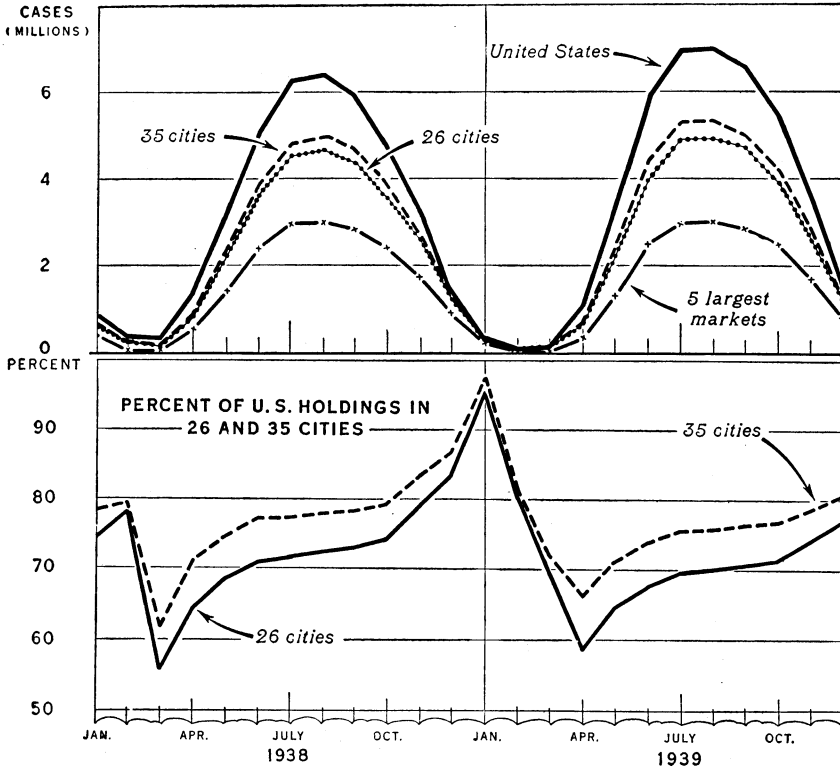


FIGURE 6.—Cold-storage holding of eggs, January 1938–December 1939. Cold-storage holding of eggs (1) in the United States, (2) in the 5 largest markets, (3) in 26 markets, and (4) in 35 markets, and the percentage of total United States holdings in the 26 markets, and in the 35 markets 1938 and 1939. Stocks of eggs normally begin to accumulate in storage in March, increase rapidly in April and May, increase more slowly in June and July, and reach their high point about August 1.

ing month by the Agricultural Marketing Service. Reports of the holdings of shell eggs in 10 of the principal markets are available daily and those of holdings in 26 cities weekly. The holdings of shell eggs in the 26 cities,<sup>2</sup> except when very small in quantity, show a rather regular relationship to the total United States holdings and can be used successfully to estimate the total United States holdings

<sup>2</sup> New York, Chicago, Philadelphia, Boston, Providence, Buffalo, Syracuse, Cuba (N. Y.), Lowville (N. Y.), Pittsburgh, Cleveland, Detroit, Minneapolis, St. Paul, Milwaukee, Plymouth (Wis.), Marshfield (Wis.), Green Bay (Wis.), Denver, Kansas City, St. Louis, Omaha, Portland (Oreg.), Seattle, San Francisco, and Los Angeles are the 26 cities. In the 35 cities the additional cities are Springfield (Mass.), Cincinnati, Duluth, Fort Worth, Dallas, Petaluma (Calif.), Santa Rosa (Calif.), San Diego, and Oakland.

as of the first of each month before the latter figures become available. To meet the demand for a weekly report of holdings which would include more cities and, therefore, a larger proportion of the total United States holdings of shell eggs, a weekly report is now issued for the 26 cities and one for 35 cities. The 35 cities include the original 26 and also 9 additional cities. Although the holdings in the 35 cities are larger than those in the 26 cities it does not appear that they form a much better basis for estimating the total United States holdings (fig. 6).

Holding eggs in cold storage is a legitimate and needed market function which benefits both producers and consumers. Without cold storage, eggs would be in such supply in the spring that they would hardly be worth gathering in many localities; in the fall the supply would be far from sufficient to meet the demand, and the price would be so high as to be prohibitive to many consumers. Through the storage of eggs a demand is created in the spring for the surplus, resulting in better prices to the producers; in the fall a supply of wholesome storage eggs is available at prices within the reach of ordinary consumers, thus increasing consumption; yet the demand for new-laid eggs is generally sufficient to maintain their price at a level which makes winter egg production profitable.

## MARKETING METHODS

The methods employed in marketing eggs may be relatively simple or decidedly complex. The care, handling, and promptness associated

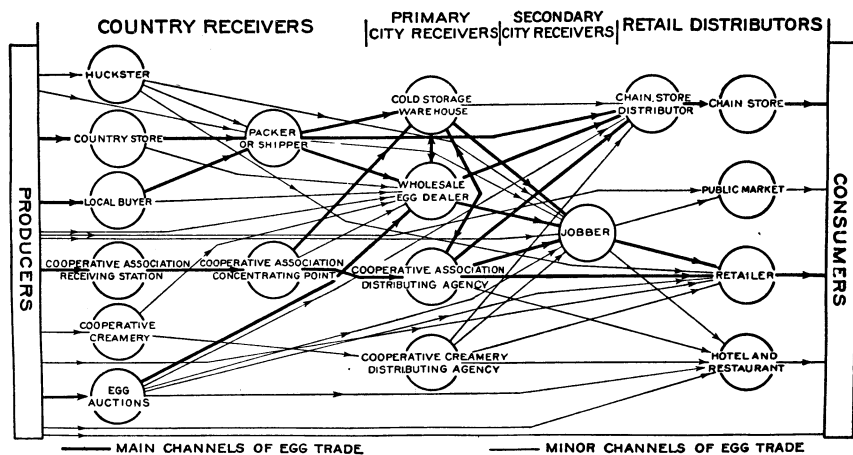


FIGURE 7.—Eggs reach their final market through numerous channels.

with each method have a decided effect upon the quality of the eggs, upon the satisfaction which they afford the consumer, and consequently upon the price generally paid to the producer.

Egg-marketing methods may be roughly divided into two groups—direct and indirect. The most direct marketing method is the sale of eggs by the producer to the consumer. Variations of the direct method

are the handling of eggs by various combinations of comparatively few persons between the producer and the consumer. In the indirect marketing of eggs the producer sells to various agencies, which in turn sell to packers or concentrators, by whom the eggs are sent to distributors in the consuming markets. Under these methods the eggs pass through a series of agencies and may be in trade channels for several weeks before they reach the consumer (fig. 7).

### **MARKET CHANNELS**

#### **Producer to Consumer**

As a rule the direct marketing of eggs from the producer to the consumer involves a considerable number of small sales, and the permanence of this outlet depends upon the delivery of a high-quality product that will give satisfaction to the customers. Whether the producer can afford to employ direct-marketing methods depends upon his proximity to a consuming market or to a consuming population and upon the relation of the time and expense entailed in establishing and maintaining such a trade for all or a goodly portion of his product to the prices obtained. In delivering eggs direct to the consumer the producer generally depends upon sales at his door or a roadside market, an egg route, or parcel post. A considerable volume of eggs is sold in the large cities by peddlers direct to consumers. Some of these peddlers may be producers, and others may be selling eggs that they obtain from producers or from dealers in the market.

#### **Producer to Retailer or Hotel**

Many producers sell direct to retailers or to hotel, restaurant, or soda-fountain trade. The prices received from such customers are often nearly as good as those for deliveries direct to the consumer, and this method has the advantage of requiring fewer deliveries with a larger volume in each. It is usually less expensive from the standpoint of the time involved than selling direct to individual consumers. Deliveries to this type of trade are usually made by truck or express.

#### **Producer to Wholesale Dealer**

A large number of producers, generally those within easy shipping distance of a large city, sell their eggs to jobbers or wholesale dealers, shipping one or more cases at a time to the market by truck or express. Such a method of sale requires considerably less effort on the part of the producer, as he does not have to establish and maintain contacts with the consuming trade. On the other hand, the return is usually less. When contact with a reliable dealer has been established, that method is often very satisfactory.

#### **The Country Storekeeper and the Egg Packer**

Many of the market eggs produced on general farms in the Middle West are marketed through the country carlot packer and shipper. This process involves the passage of the eggs through a relatively large number of hands. The farmer may take his surplus eggs to town when it is convenient and sell them to a local merchant for trade, or to a

local egg buyer for cash. In some sections hucksters with trucks go through the country and purchase the eggs at the farmer's door.

The custom prevalent among hucksters and local merchants in many sections of the Middle West of buying eggs on the "case count" basis is most damaging to egg quality. When eggs are bought on this basis, payment is made solely on the number of dozens of eggs delivered, without respect to their quality or the percentage that are good or bad. Such a system offers no incentive to the careful farmer to produce good eggs, for he receives no more than does the careless producer whose eggs are of poor quality. In the last few years there has been a decided tendency to substitute for the "case count" basis of buying, a "loss-off" basis, under which no payment is made for eggs that are unwholesome and unfit for food, and a difference, based on quality, may be made in the price paid for the good eggs. Some States have laws which regulate egg buying and require that a "loss-off" basis be used. In recent years there has been a decided growth in the purchase of eggs on a graded basis from producers at country points. Such a development is an incentive to the production of better quality eggs and, therefore, to the better care of eggs on the farm.

The country merchant or storekeeper and the local egg buyer commonly ship the eggs that they purchase to carlot packers or shippers for consolidation into carlots, or to less-than-carlot receivers in the market. A considerable time often elapses before these eggs are shipped, and the conditions under which they are kept are often so unfavorable that distinct deterioration in quality occurs. Some egg packers pay premiums to producers who bring their eggs direct to the central packing plant at regular and frequent intervals, the purpose being to encourage the proper care and frequent delivery of the eggs and to obtain them while they are still new-laid. When eggs are received by a carlot packer or shipper who uses modern equipment they are immediately placed in refrigerated rooms at a temperature generally between 35° and 40° F. and held there until they are thoroughly cooled. Some smaller shippers are not so well equipped, and the eggs may not be handled so well. In any case the eggs are candled, graded, and packed at the concentration point and shipped by refrigerated fast freight, by refrigerated truck, or occasionally by express, either in carlots or in less than carlots, to the larger markets where they go into consumptive channels immediately or are placed in storage for later sale. In the large markets the eggs are distributed by the receiver to retailers or to jobbers who, in turn, sell them to retailers, usually after further candling for retail sale.

When eggs are marketed through these channels, considerable time may elapse between the time the egg is laid and the time it reaches the consumer. Often it takes 3 weeks and in some cases longer. When the eggs are held in cold storage for future sale, they do not, of course, reach the consumer until they are several months old.

#### EXCHANGE TRADING IN EGGS

In some of the large egg markets there are exchange organizations composed of wholesale dealers. These exchanges maintain quarters where wholesale trading may be done on each business day. The exchanges formulate rules that govern trading in eggs and the other commodities handled by their members. Most of the trading on

exchanges consists of spot sales, that is, sales for immediate delivery. A few exchanges also provide futures sales, that is, sales of product for future delivery. Dealing in futures is frequently resorted to by shippers for hedging purposes, that is, to insure them against loss in the value of the eggs while in transit to the consuming markets. The prices at which sales are made on the exchange boards and at which sellers offer eggs and buyers bid for them sometimes constitute the basis on which market quotations are established. In other cases the sales, bids, and offers on the exchange, together with "street" sales or sales made by the dealers in the market, are taken into consideration in arriving at market quotations.

### COOPERATIVE MARKETING

Egg producers in many sections have formed cooperative marketing associations. This action has usually resulted either because of prices which the producers considered to be unsatisfactory or because of overstocked local market conditions which make it necessary to sell the surplus in distant markets. The cooperative marketing associations vary from small local enterprises to large associations operating over a considerable territory. In 1940, 181 cooperative associations in the United States were handling poultry and eggs as their primary business. Several hundred additional associations handled eggs as a sideline activity.

Some of the bigger egg-marketing associations handle the eggs of a large number of producer members. These eggs are collected at local receiving stations, from which they are taken to a central packing plant, where they are carefully graded and shipped to market in carlots under refrigeration. The large cooperative poultry and egg associations of the Pacific coast are excellent examples of the successful operation of such a plan of marketing.

### EGG AUCTIONS

In the Northeastern States in particular, and to a lesser extent in adjacent territory, a method of marketing locally produced eggs has been developed through the establishment of egg auctions (fig. 8). These auctions have had a rapid and steady growth during recent years. In 1940, 20 of them were dealing in both eggs and poultry, 7 were handling only eggs, and 2 handled only poultry. The total volume of eggs and poultry sold at these auctions in 1939 amounted to 1,200,000 cases of eggs and 250,000 crates of poultry. The sales value of these products was approximately 11 million dollars.

Under this arrangement the egg-auction members grade their eggs for size and cleanliness and deliver them to the auction for sale. At the auction each case of eggs is usually inspected for grade by having 10 eggs from each filler examined. As the result of this inspection each case of eggs is labeled with the particular grade to which it conforms which is in use by the auction. Usually these are State grades or United States grades, and the auctions are generally operated under State supervision. It is customary to hold two auctions a week, at which most of the eggs are offered as individual-producer lots. Stated charges are made for the inspection and handling of the eggs, and the rest of the price received is remitted to the individual producer.

The egg auctions are patronized by milk distributors, operators of egg routes, large retail stores, chain stores, and egg dealers. The

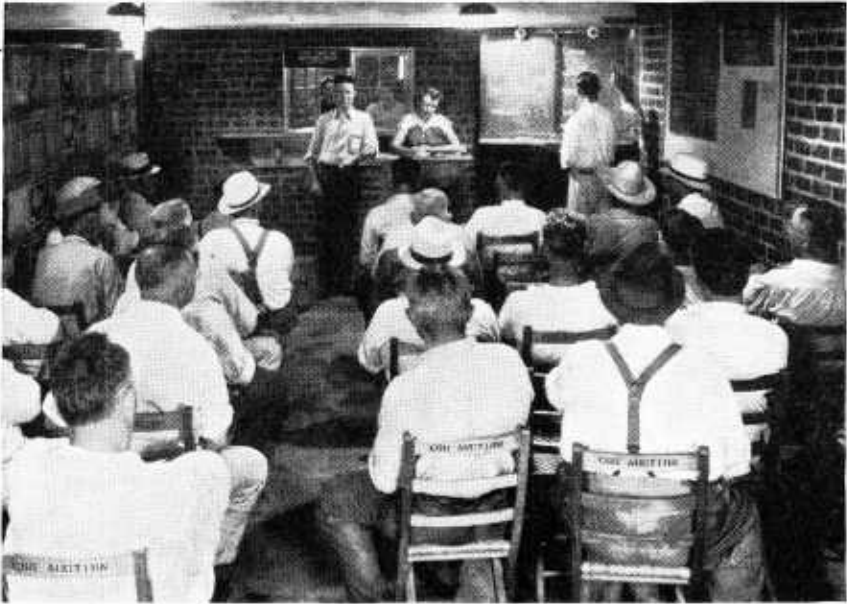


FIGURE 8.—The grade and weight of the eggs are usually shown on a blackboard at the egg auctions as each lot is sold. The advantage of this type of egg marketing is that generally the overhead cost of operating is low.

auctions constitute a source of supply for considerable volumes of nearby eggs of good quality.

### EGG STRUCTURE AND COMPOSITION

To understand the conditions or factors that may affect the quality of eggs some information concerning their structure and composition is essential (fig. 9). The yolk of the egg is suspended in the white at approximately the center of the egg and is surrounded by the vitelline membrane. On the surface of the yolk, and usually on its upper side, is the germ or germinal spot. In some cases there may be more than one of these. In an infertile egg this germ spot is small and irregular in shape; in a fresh fertile egg it is round and larger. This germ, in a fertile egg, under proper temperature conditions, develops into the embryo. The size of the germ spot, therefore, varies, depending upon the degree to which this development has taken place.

The white of the egg consists of albuminous material which fills the space between the yolk and shell. In a normal fresh egg there are apparently two parts to the white, a thick, viscous portion immediately surrounding the yolk, and a thin or more liquid portion filling the space between the thick white and the shell membrane. Actually, however, there is some additional thin white enclosed in the envelope of thick white and, therefore, lying between it and the yolk. There is also a slight layer of thick white immediately surrounding the yolk and extending out toward each end of the egg in twisted whitish por-

tions resembling twisted cords. These cords are called chalazae. They allow the yolk to rotate freely as the egg is turned but serve to retard the rise or settling of the yolk toward the shell when the egg is left in one position for any length of time. Except for the chalazae the white is generally clear or transparent. In very newlaid eggs, however, and in other eggs under certain conditions, the white may be cloudy. Certain types of deterioration or the eating of certain feeds may cause the egg white to be discolored.

The shell is composed largely of lime. It is somewhat porous in structure and allows the evaporation of water from the egg contents. It also permits the penetration of odors and flavors from without, and, under unfavorable environment, the entrance of bacteria. Immediately lining the shell are two membranes which serve as a secondary protection to the egg contents. When the egg is first laid and is still

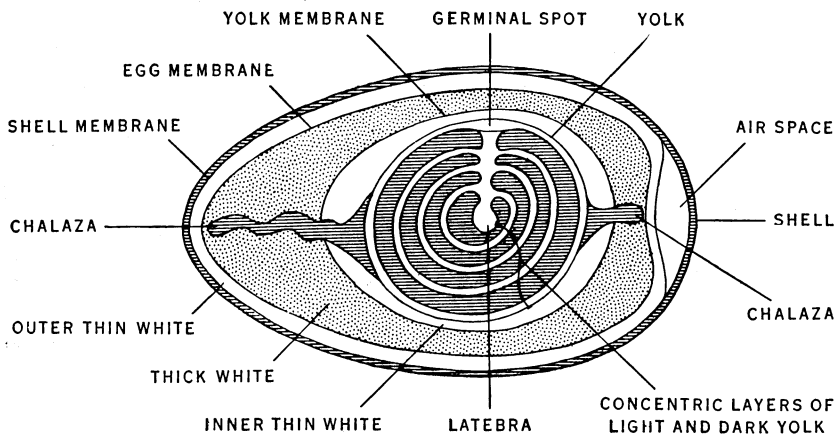


FIGURE 9.—The parts of an egg.

warm, the contents entirely fill the shell. As the egg cools, the contents shrink, and there is some loss of gas, which causes a small air cell to form between the two shell membranes, usually at the large end of the egg, where these membranes separate most easily. Further evaporation of water from the contents takes place with the aging of the egg, and the air cell gradually grows larger (fig. 9). Also as the egg ages there is some absorption of water by the yolk from the white by osmotic action.

The shell comprises approximately 11 percent, the white approximately 57 percent, and the yolk 30 to 32 percent of the entire weight of a new-laid hen's egg. As the egg ages, the white constitutes a lesser percentage and the yolk a greater percentage of the total weight. The water, protein, and fat content of the whole egg (edible portion), the egg white, and the egg yolk, is given in table 3. The eggs of other classes of poultry differ somewhat from hen's eggs in their composition, but this difference is small.



TABLE 3.—*Water, protein, and fat content of the edible portion of the hen's egg*

Class	Water	Protein	Fat
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Whole egg:			
2-day-old.....	74.06	12.88	11.40
Commercial.....	73.95	12.75	11.55
Storage.....	73.39	12.88	11.67
Egg white:			
2-day-old.....	87.85	10.69	.02
Commercial.....	87.79	10.75	.03
Storage.....	86.72	11.44	.03
Egg yolk:			
2-day-old.....	48.47	16.94	32.54
Commercial.....	49.53	16.31	31.88
Storage.....	53.46	15.19	29.04

SOURCE: Journal of the Association of Official Agricultural Chemists, May 1932, based on analyses made by Chicago station, United States Food and Drug Administration. Each sample consisted of 24 or more eggs.

### FACTORS AFFECTING QUALITY

To insure that eggs reach the consumer in good edible condition and to eliminate or reduce the enormous waste through deterioration and spoilage, eggs must be handled intelligently from the time they are laid until they are used, and the whole marketing process must be expedited as much as possible.

Quality is determined by four primary factors: condition of the shell, condition of the air cell, condition of the yolk, and condition of the white. As all these parts except the shell are inside the egg, their condition is determined commercially by the process known as candling.

#### Shell

In eggs of first quality the shell must be strong, unbroken, normal (free from abnormality of structure which may noticeably affect the shape or cause weakness), and clean. Strength and unbroken condition are necessary to insure good shipping and good keeping quality. Cleanliness affects both price and keeping quality, since clean eggs are more attractive in appearance and dirty eggs spoil more rapidly than do clean eggs.

#### Air Cell

The air cell normally develops at the large end of the egg through the separation of the two shell membranes and the filling of this space with air. In eggs of best quality the air cell is small, not over one-eighth inch in depth, measured from the end of the shell to the plane passing through the egg at the lower edge of the air cell where it touches the shell. The air cell normally occupies a fixed position in the egg and is not movable. However, there may be some slight tremulous condition of the air cell due to mechanical causes which have no relationship to quality. Large air cells are an indication of staleness or age. Freely movable air cells indicate that the cell membranes are completely separated or broken.

#### Yolk

The yolk of a fresh egg should be well centered and its outline as viewed before the candle only moderately defined. It should have rather limited freedom of motion. Free motion and a more clearly defined outline generally indicate lower quality. Detachment of the

chalazae may permit the yolk to rise and stick to the shell, particularly when eggs are packed with their small ends up. When a fresh egg is broken out in a dish the yolk should be well rounded, or "stand up" well; the yolk of a stale egg is flatter and more spread out. The color of the yolk may range all the way from a pale to a deep yellow or even be of a reddish cast. The color of the yolk depends largely upon the amount and character of the green feed which the hens have received, and, therefore, generally varies considerably with the season.

The color of the yolk may affect the price of the egg to a limited extent, especially when some particular demand is to be met. Many consumers prefer a fairly deep-colored yolk, but in some markets a demand has been developed for eggs with pale yolks.

In considering the yolk, the condition of the germ is one of the factors taken into consideration. In a fresh egg the germ should show no visible development before the candle, and even when the egg is broken out of the shell the germ spot should show little or no development. If fertile eggs are subjected to a temperature of 68° to 72° F. or over, the development of the germ will proceed, although perhaps at a slow rate. The spot may be one-third inch in diameter or larger before any blood due to embryo development is apparent. As soon as blood due to germ development shows, the egg is no longer considered edible. The development of the germ spot before this point is reached does not render the egg inedible but affects the quality adversely in proportion to such development.

#### White

The white of an egg of good quality should be reasonably firm and clear. Weak or thin white indicates staleness or faulty condition of the egg when laid. A bloody white or large blood spots or meat spots on the yolk or in the white cause the egg to be classed as inedible. Small blood clots or meat spots usually do not cause the egg to be classed as inedible but reduce its market value. Some municipal regulations declare all blood spot eggs to be inedible.

#### Secondary Factors

In addition to the primary quality factors mentioned, there are two other factors which affect or may affect the value of eggs. These are the color of the shell and the size or weight of the egg. These factors can be determined without candling; they do not affect the wholesomeness of the egg, but may affect the price at which it is salable. Whether the shade of color will affect the price depends upon the preference which may exist in a particular market for eggs of a given color. For example, white eggs generally, although not always, command a premium in New York and in certain other markets, whereas brown eggs are in greater demand in other markets, such as Boston. On any market it is important that a specific lot of eggs be uniform in color; that is, all brown or all white, rather than brown and white mixed. A mixture of colors adversely affects the appearance of the eggs as a lot and consequently usually affects the price adversely.

Uniformity in size favorably affects market price because a lot of uniform size presents a more pleasing appearance. The weight of a

lot of eggs also affects price since the heavier eggs have more food value than the smaller eggs. Mixing small eggs with normal-size eggs is sure to detract from the market value. Small eggs should be sorted out and used at home or packed and marketed separately. Unusually large eggs marketed in standard packages are more likely to break and if broken they are not only a loss in themselves, but they smear and damage other eggs.

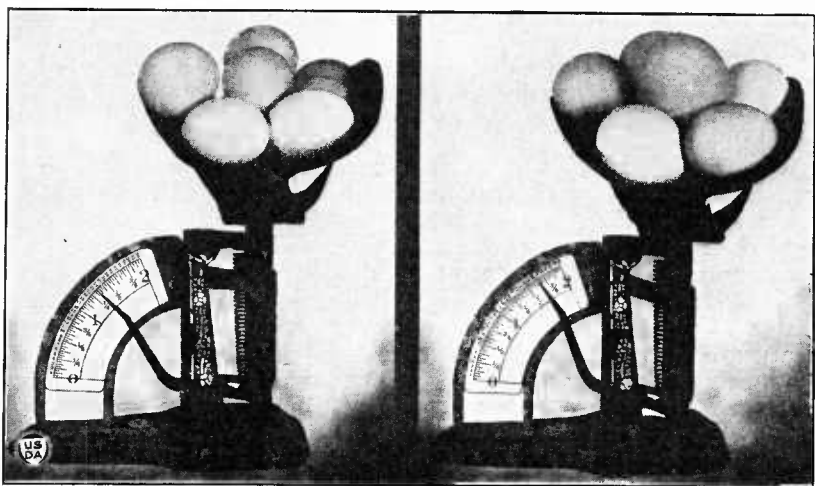


FIGURE 10.—The food value of eggs varies in direct proportion to their weight. The dozen eggs on the left weigh  $21\frac{1}{2}$  ounces, the dozen on the right  $26\frac{3}{4}$  ounces. Their quality is the same.

Official market grades usually specify minimum net weights per case. Since the food value of a dozen eggs is directly proportionate to their weight, it is obvious that weight should be important in determining price (fig. 10). Eggs are quite commonly classified according to their weight or size as Large, Medium, or Small. Unusually large eggs may also be packed separately and sold as Jumbos. In packing eggs of Jumbo size it is desirable to pack them in special containers in such a manner as to reduce the likelihood of breakage. For small eggs, instead of the designation Small the designation Pullets is quite commonly used. For unusually small eggs the designation Pee-wees is often used.

Besides meeting the standards already enumerated, eggs should be free from any abnormal flavor or odor. Among the most common abnormal flavors found in eggs are sourness and mustiness. Foreign flavors are readily absorbed by eggs from any strong-smelling material kept near them. It is impossible to detect these defects by candling, but care should be taken to prevent their development by keeping the eggs under good conditions. Storage flavor is a common characteristic of eggs that have been held in cold storage for a considerable period.

### FARM CARE ESSENTIAL TO GOOD QUALITY

Most eggs are of good quality when first laid. If they are to retain this initial quality and reach the market in good condition, they must be properly cared for and handled by the producers and all other

persons taking part in the marketing of the eggs. No marketing process can improve an egg of poor quality. All that can be done is to

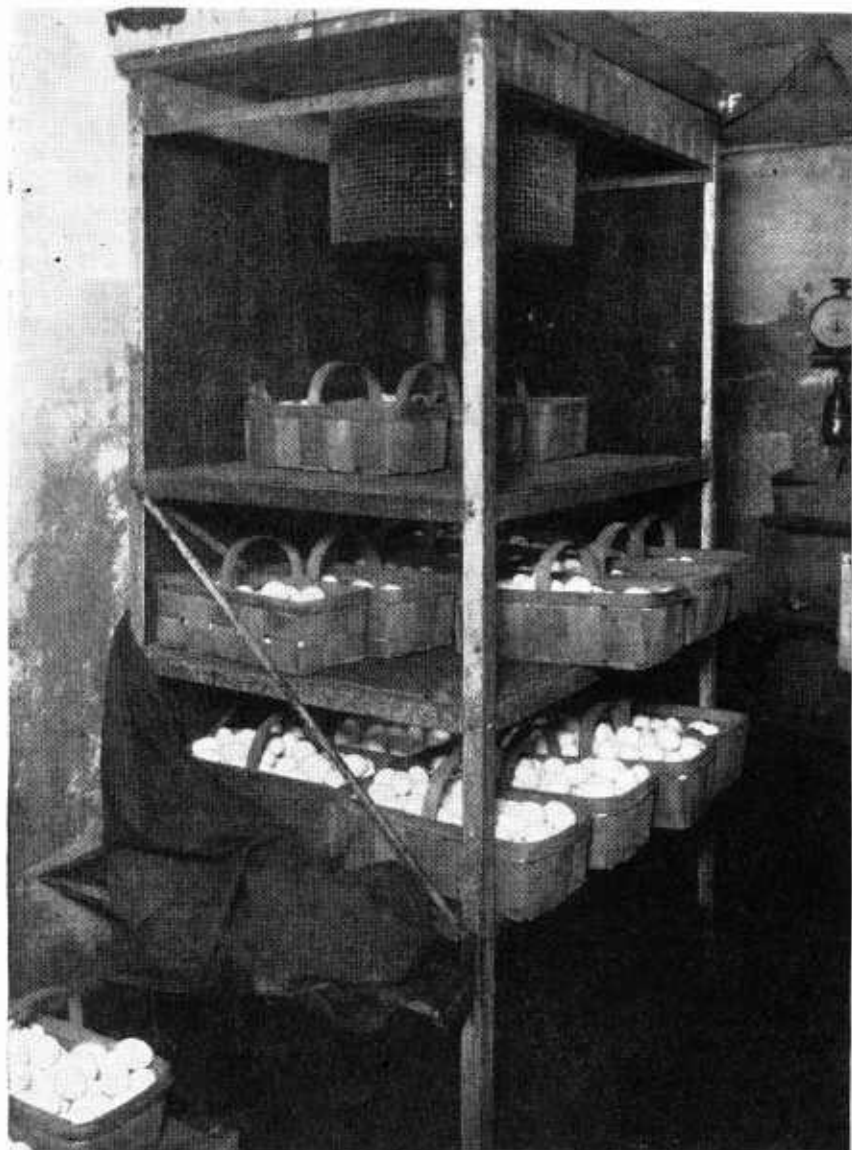


FIGURE 11.—Rapid cooling is essential to preserve egg quality. In the above arrangement heavy burlap saturated with water from the drip pans above enclose the metal frame. A fan suspended from the top drives the humid air through the egg baskets, and the heat of the egg is greatly reduced in an hour's time.

preserve as nearly as possible the original quality. Good care on the farm is, therefore, a prerequisite to the marketing of good eggs.

First of all good poultry stock bred to as great a degree of uniformity as possible is necessary in order to produce eggs of uniform size and

color. The flocks must be well housed, fed, and cared for in order to increase productivity. As soon as the hatching season is over all male birds should be disposed of or separated from the hens so that only infertile eggs of superior keeping quality will be produced. Nests, clean and sufficient in number, must be provided in order to obtain the largest possible percentage of clean eggs. Dirty eggs should never be washed unless intended for immediate consumption. Washing reduces the keeping quality and results in greater loss, especially if the eggs are placed in cold storage.

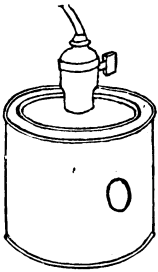


FIGURE 12.—An electric light and a tin can with removable top make a cheap and easily constructed egg candle.

Eggs should be gathered frequently, at least once a day. During very hot or very cold weather it is desirable to gather them two or three times a day to prevent them from being heated or frozen. They should be kept in a cool, moderately moist place to maintain their quality and to prevent evaporation (fig. 11). They should be spread out or kept in a wire-mesh container until the animal heat has been removed before they are packed in the egg case for market. All very small or very dirty eggs should be

used at home or sold to local consumers. They should not be shipped to market as they have a tendency to depress the market price. Very large eggs should be sold locally, used at home, or packed separately in such a way as to reduce breakage, before they are sent to market.

### CANDLING EGGS

Eggs are candled to determine their quality as shown by the condition of the air cell, yolk, and white. Candling consists of holding the egg before a strong light, usually artificial, in such a way that the rays of light penetrate the egg to a considerable extent, thus making it possible to observe the condition and behavior of the contents. Most producers do not candle eggs, although buyers and dealers find it advantageous to do so. Where a high-class retail trade is being catered to by producers, candling is necessary, for some absolutely fresh, new-laid eggs are unsuitable for food and if delivered to the consumer will hurt the reputation of the producer. Such eggs are those with bloody whites, large blood spots, and large meat spots. It is also desirable to remove, where they can be detected, eggs with small blood spots or small meat spots, which, while not rendering the eggs inedible, do cause them to be considered of lower grade.

Home-made egg candles may be easily and cheaply constructed with any light sufficiently strong. An electric light is best, but a good kerosene lamp, a gas flame, or sunlight can be used. A satisfactory home-made candle can be constructed from a tin can of sufficient size to hold an incandescent lamp. The lamp cord should be run through a hole in the removable top of the can and a round hole,  $1\frac{1}{4}$  inches in diameter, should be cut in the side of the can opposite the light filament. This makes a satisfactory home-made candle where electric light is available (fig. 12).

When being candled, the eggs are held in a slanting position with the large end against the hole through which the light passes. The egg is grasped by the small end, and while held between the thumb

and tips of the first two fingers it is given one or two quick turns on its long axis (fig. 13). This causes the contents of the egg to move and

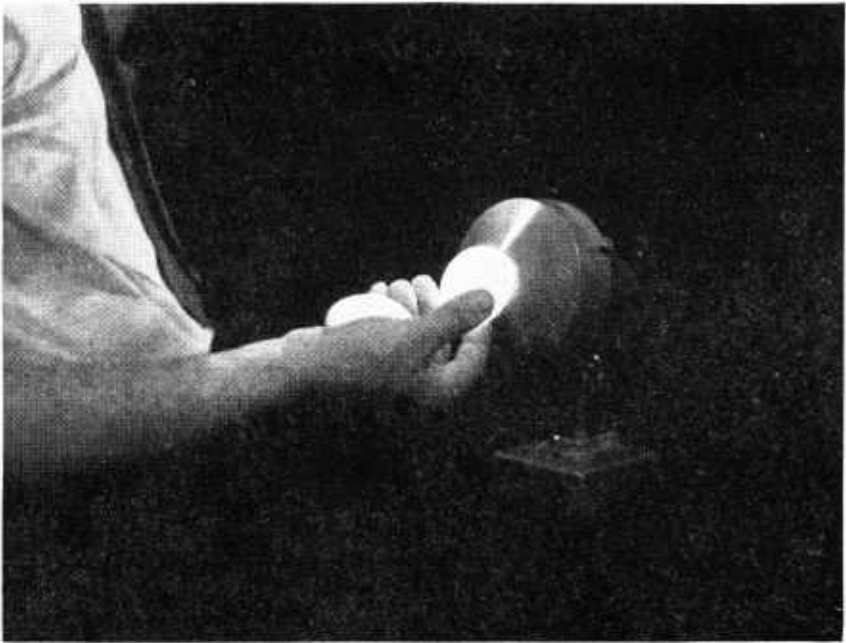


FIGURE 13.—There is a best way to hold and handle eggs while candling.

throws the yolk nearer the shell, allowing its condition to be more carefully observed.

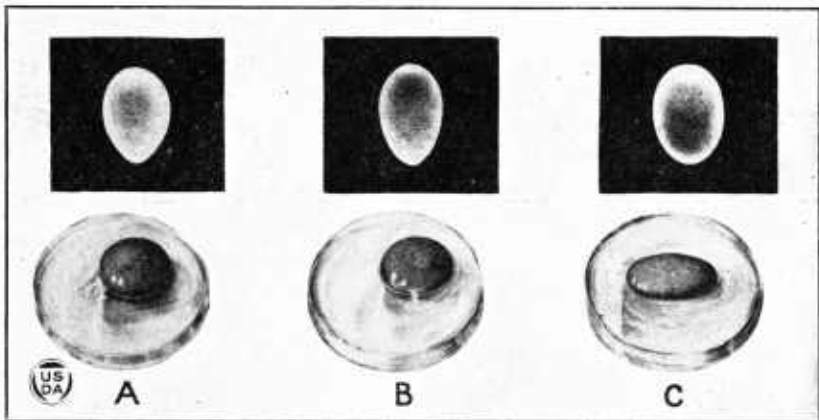


FIGURE 14.—The common classes of edible eggs show differences, both before the candle and when broken out, which serve to distinguish them readily. *A*, Fresh egg, with strong well-rounded yolk; *B*, heated egg, showing germ development; *C*, stale egg, having weak, flattened yolk.

The egg must be turned so that its entire surface is exposed to the candler's view. Otherwise the only evidence of an undesirable condi-

tion might occur in that portion not observed by the candler, and the egg would be misgraded. For the same reason as little of the egg as possible should be obscured by the thumb and fingers holding it. The dark color of the shells of brown eggs makes them more difficult to candle than white eggs. It is not necessary for producers to have extensive and detailed knowledge of candling, but they should be able to distinguish a fresh egg from a stale egg and to detect undesirable conditions. In a fresh egg the air space is small, measuring not over one-eighth inch in depth. The yolk should have an outline which is only moderately defined. There should be no visible development of the germ spot or other evidence of defects or blemishes on the yolk when the egg is candled. The white should be reasonably firm and should be free from foreign particles, such as meat spots or blood clots (fig. 14A).

In a stale egg the air cell is larger, and the outline of the yolk is much more definite. The yolk usually moves more freely in the egg,

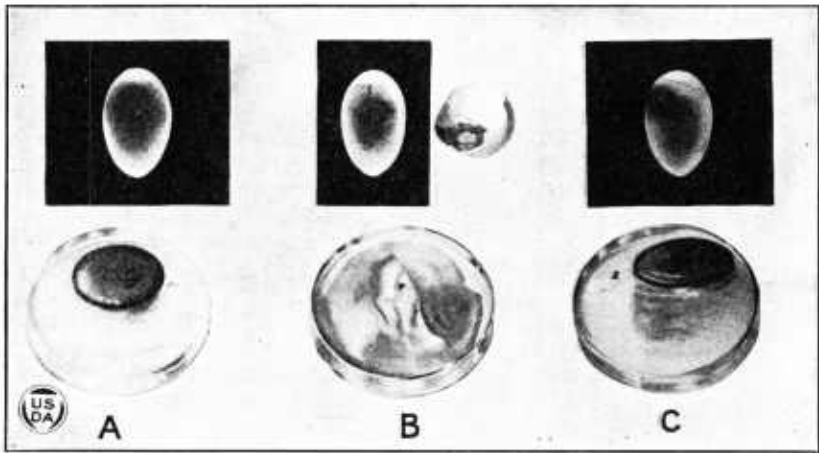


FIGURE 15.—These are common types of inedible eggs distinguishable before the candle. A, blood ring; B, moldy cracked egg; C, egg with yolk beginning to adhere to shell.

and the white is generally thinner or more watery (fig. 14C). In a heated egg the germ spot is likely to show development, and the air cell is usually enlarged, although in some cases it may still be comparatively small. In such an egg the yolk is likely to be above the equator of the egg, and its outline is quite pronounced. The development of the germ spot is usually visible as a spot of more pronounced or reddish color on the yolk (fig. 14B). If a blood ring or blood veins are visible the egg is classed as inedible. Stale and heated eggs are of poor quality and are placed in a lower grade.

Fresh eggs may have bloody whites. Before the candle they can be distinguished by the red color of the white and often by irregularly shaped bodies or blood clots generally on the surface of the yolk but sometimes floating in the white.

Foreign material shows as dark-colored particles in the white, often called "meat" spots. Blood rings or veins indicate that the embryo has developed to a point where blood is visible. If the embryo or germ has died the blood usually collects in a ring or circle known as

a blood ring (fig. 15A). Such eggs are common during hot weather if fertile eggs are held at ordinary room temperatures for any considerable time. Eggs showing blood rings are classed as inedible.

Various other classes of eggs are unsuitable for food, such as stuck yolks, moldy eggs, and rots (fig. 15B and C). Most of these are easily

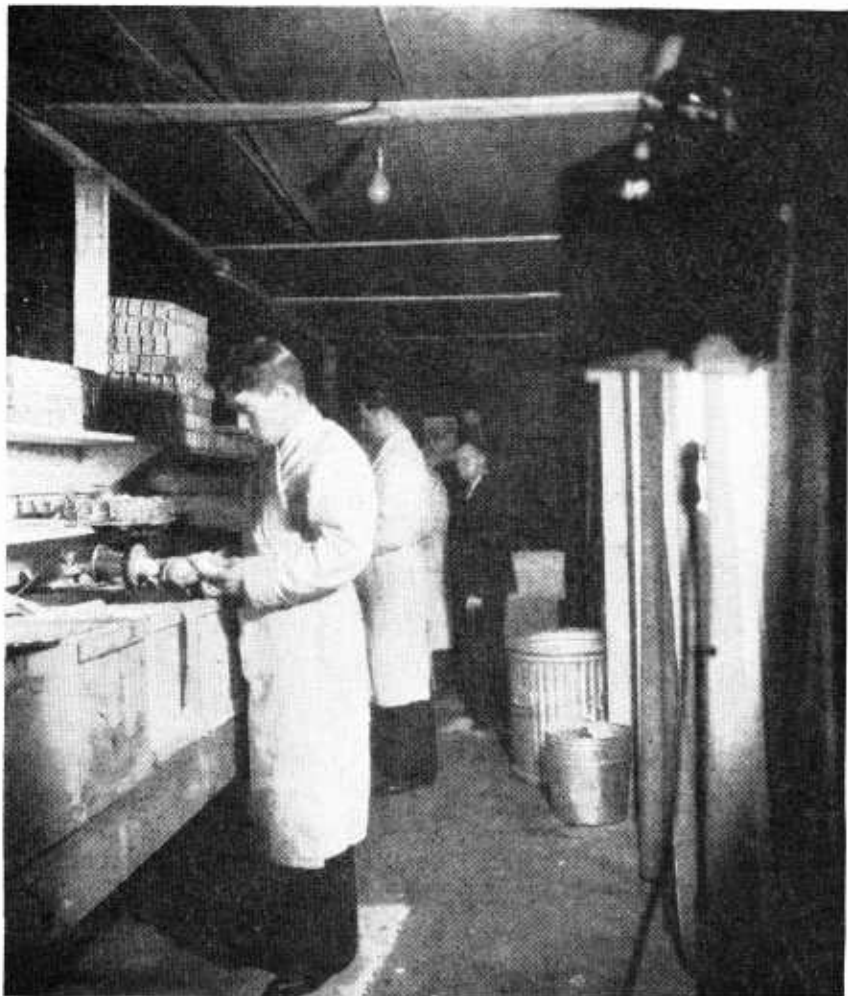


FIGURE 16.—If the egg is properly held before the candling light the depth and condition of the air cell is readily apparent. If the egg is given a slight twirl the condition of the yolk and white is easily observed.

distinguished before the candle and are of interest to the producer only because they should not be sent to market and because their occurrence should be prevented. Eggs sometimes have minute cracks or blind checks that are invisible to the naked eye but are apparent before the candle. These should not be sent to market but should be used at home as they will not keep well and are more easily broken.

All handlers of eggs, from the producers to the city jobbers, should



satisfy themselves of the quality of the eggs that they buy or offer for sale. This can be accomplished only by candling. In commercial packing plants the candling should be done by trained candlers in rooms maintained at a temperature of not over 65° F. The "candle" used should consist of an electric-light bulb enclosed in a metal shield which should have only one hole, against which the eggs are held for candling.

The candler stands before the light, which should be fastened at a convenient height, usually 38 to 44 inches from the floor. He handles the eggs very rapidly. At his side or directly in front, on a shelf 22 to 26 inches high, is placed the case of eggs to be candled. After removing the top packing the candler lifts the first filler out of the case, leaving the eggs lying loose on the next flat. He picks up the eggs, two in each hand. After candling one egg in each hand, by a quick manipulation of the thumb and fingers he reverses the position of the eggs and candles the other egg in each hand (fig. 16). As the eggs are candled they are graded, and each egg is placed in the proper case for its grade, such cases being placed on the candling bench in locations convenient to the candler. At concentration points it is customary to pack the eggs after candling in new packing materials and in new cases. The average candler, working at a steady pace but without undue effort, should candle from 18 to 25 cases of eggs in an 8-hour working day. Storage eggs and others of uncertain quality should always be recandled in the final distributing and consuming markets before they are offered to the retail trade. It is customary to recandle most other eggs in the consuming market, although more and more effort is being made to candle the eggs at country shipping points in a sufficiently careful and satisfactory manner so that recandling at the consuming market will be unnecessary.

In learning to candle eggs the beginner must train his eye to look for the points which have been enumerated and to note them quickly. Frequent checking of the candler's judgment by breaking out eggs, particularly those about which there is doubt, will prove very instructive and will be of great assistance to the beginner in acquiring confidence and skill.

## GRADING EGGS

The grading of eggs is merely a process of sorting them according to quality and of packing each quality separately. Sometimes the word "grading" is used to refer only to the sorting of eggs for size, but generally it implies sorting for all the qualities taken into consideration in packing eggs for market.

Grading eggs for size is simple and should never be neglected by producers. It consists merely of sorting the eggs according to different size classifications, as well, of course, as taking out all very small, very dirty, or cracked eggs and retaining these for home consumption, or for local sale, if such an outlet can be arranged. If every producer practiced this simple method of grading, the average quality and character of the eggs arriving at the consuming markets would be considerably improved.

In the regular commercial channels of trade, eggs are often graded for the first time at the point where they are concentrated and packed for shipment to market. The candling, grading, and packing are commonly done in a single operation. In some plants, however, the grad-

ing for interior quality is a separate operation performed by the candler, while the sorting for size, color, and cleanliness is the job of other operators, working usually under daylight conditions.

When disputes arise in the large markets about the grade of a lot of eggs, it is possible to obtain an official grading or inspection of the eggs either by Federal or Federal-State graders or by graders employed by a mercantile or produce exchange. Standard fees are charged for this service.

### EGG GRADES

Eggs received at the various markets may differ widely in quality as the result of the conditions under which they have been produced and handled. To provide a practical basis for trading and for the reporting of prices, it is customary to establish grades based on quality and to grade the eggs accordingly. Usually each market has its own ideas of grade, and the result is a decided lack of uniformity throughout the country. A grade name in one market may not signify the same quality in another market. Such a lack of uniformity in grades causes confusion and uncertainty, especially in trading between widely separated markets and in comparing market quotations of different markets.

Results obtained in using uniform grades in the marketing of other agricultural products seem to indicate that the use of uniform grades in the egg trade would promote a more perfect reflection of true values in all markets, would stimulate a freer trade between distant markets on a satisfactory basis, and would help to create confidence and to eliminate confusion in marketing.

The United States Department of Agriculture has formulated standards of quality applicable to individual eggs. On the basis of these standards it has also formulated tentative United States wholesale and United States retail grades. The wholesale grades are intended for use in wholesale channels of trade, while the retail grades are for use with eggs prepared for sale to consumers. The United States standards and grades for eggs are applied uniformly throughout the country and throughout the different seasons. The use of the United States standards and grades as such or through their incorporation in other grades is increasing steadily. It is believed that they will provide a greatly needed common language of quality for eggs and should prove to be an important factor in improving marketing conditions.

The names applied to the United States retail grades for eggs are as follows beginning with the highest grade: U. S. Specials or Retail Grade AA; U. S. Extras or Retail Grade A; U. S. Standards or Retail Grade B; U. S. Trades or Retail Grade C.<sup>3</sup>

In most markets eggs are divided into two general classes based upon freshness: Fresh, or fresh-gathered, and refrigerator or storage. Under this classification fresh eggs are those which are not required to be sold under some other class designation, such as refrigerator. Cold-storage or refrigerator eggs are those which have been in cold storage under conditions or for such a length of time as to prohibit their sale as fresh eggs or to require them to be sold as cold-storage or refrigerator eggs. In the last few years a number of States have

<sup>3</sup> For detailed information concerning the United States standards and grades for eggs, write the Agricultural Marketing Service, U. S. Department of Agriculture, Washington, D. C.

passed fresh-egg laws. In general such laws specify that eggs may not be sold under the designation fresh or by any term of similar import unless the eggs meet certain quality requirements, usually approximately those of the United States retail grade of Extras.

In most markets a separate class is made of processed or shell-treated eggs, that is, eggs which have been oil-treated the better to preserve their quality. In some markets a separate class is also made for short-held or held-fresh eggs, which have not been in cold storage a sufficient length of time to require their sale as storage or refrigerator eggs but which may not have reached the market promptly or may have been held under moderate refrigeration for a short time and, therefore, do not conform to the requirements either of fresh eggs or storage eggs.

In addition to the division into the above classes, a division is also commonly made on the basis of packing. "Storage-packed" eggs are eggs that are packed especially for storage in new standard cases and with new standard fillers and flats. Other packs are recognized, including "eggs in shipping cases," which may allow the use of good second-hand cases. Usually second-hand packing materials are also used in such a pack, but the fillers and flats should either be new or, if secondhand, in good condition in order to protect the eggs properly.

The eggs are further commonly divided into grades based upon quality. In these quality grades, subgrades are likewise provided, based on the net weight of the eggs per case, such as large, medium, and small.

Duck, goose, and guinea eggs are received on some markets in considerable quantities. Duck eggs are usually quoted separately with differences in their quality reflected by different prices. Sometimes duck eggs are quoted, according to the point of origin, as "duck eggs, southern" and "duck eggs, western."

Goose eggs are received in much more limited quantities. They are usually quoted in a single grade. The price which they will bring depends upon their condition and the supply available. Usually there is little demand for them except at Easter time.

Guinea eggs are not often quoted as such. They are more likely to be received mixed with hen's eggs, particularly in the South, and are often marketed in one of the lower grades of hen's eggs.

## EGG PACKAGES

### CARTONS

The smallest unit package used for the merchandising of eggs is the pasteboard carton. The commonest size carton is one that holds 1 dozen eggs, although cartons for holding  $\frac{1}{2}$  dozen each are used to some extent. Cartons which hold 1 dozen eggs each and are perforated through the center so that the package can be broken and each half-dozen sold separately, are also used to some extent.

The more convenient and, as a rule, the more substantial cartons are those known as the "2 by 6," which hold two rows of six eggs each. Such cartons can be packed in the ordinary 30-dozen egg case. The carton is equipped with a filler similar to that used in the regulation egg case, with separate compartments for each egg.

Egg cartons are not used by producers unless they have developed a trade direct with consumers. Cartons for packing in 30-dozen

cases are used only to a limited extent when the eggs will be shipped a great distance, since, in that event, there is greater danger of broken eggs and spoilage of the entire package and consequent necessity of repacking than when eggs are to be shipped a comparatively short distance. Improvement in cartons, however, is making the shipment of eggs so packed much safer than formerly, and an increasing number of eggs are being packed in cartons for shipment and with increasing success. For additional safety 24 instead of 30 cartons are frequently packed in a 30-dozen case, a cushion flat or pad being used between each two layers of cartons.

### EGG CASES

The common container used by producers in shipping or taking eggs to market is the standard 30-dozen case. This is the case used by egg packers. Producers often use second-hand cases, especially in areas close to large consuming markets, where such cases are readily available. Second-hand cases are used because of the lower cost involved. If second-hand cases and packing materials are resorted to, only those that are good and sound should be utilized. Packers operating egg-packing stations should always pack their eggs in new cases and new packing materials.

The standard 30-dozen case is manufactured by firms which specialize in that type of case. The cases are shipped knocked down and are generally put together in the packing plants where they are used.

The standard 30-dozen case has the following dimensions: Outside, 25 $\frac{7}{8}$  inches long, 12 $\frac{1}{2}$  inches wide, and 12 $\frac{7}{8}$  inches deep; inside 24 inches long, 11 $\frac{3}{4}$  inches wide, and 12 $\frac{1}{2}$  inches deep. It is constructed of odorless wood with a partition in the center extending from side to side and dividing the case into two equal square compartments with a capacity of 15 dozen eggs each. The cases are made as light as possible while still attaining the requisite strength. The sides, top, and bottom must be not less than three-sixteenths of an inch in thickness and of not more than two pieces each. The center partition and the ends must be not less than seven-sixteenths of an inch in thickness and of not more than two pieces each. It is important that the center partition be in the true center of the case so that the two compartments will be of equal and proper size and the eggs and packing materials have neither too little nor too much room.

In nailing the cases together 3-penny cement-coated large-headed nails are used as follows: 18 on the side (6 in each end and 6 in the center), 21 on the bottom (7 in each end and 7 in the center), 8 on the top (4 in each end and none in the center), except where a drop-cleat cover is used 3 nails in each end will suffice (fig. 17). Each case must be equipped with fillers for holding the eggs and with flats which are used between the fillers and at the top and bottom of the case.

Fiber egg cases have also been tried to a considerable extent. At present the 30-dozen fiber cases are not in extensive use, but fiber cases holding 15 dozens each are being used to an increasing extent, particularly in terminal markets where eggs are packed in such containers for delivery to retail stores. The 15-dozen fiber cases have the advantage for this use of being a neater appearing package and also of enabling jobbers or packers of eggs more conveniently to deliver smaller quantities of eggs to the retailer.

## FILLERS AND FLATS

The filler in ordinary use is  $2\frac{1}{4}$  inches deep, is made of strawboard or pulpboard, and contains 36 square cells arranged in a square with 6 on a side. Five such fillers, each holding 3 dozen eggs, are used in each side of the 30-dozen case, or 10 fillers in all. Fillers of this style are commonly referred to as honeycomb fillers. Special fillers, like the standard filler in construction except that the cells are larger and that there are only 25 cells to a filler instead of 36, are sometimes used in packing and shipping duck eggs in the regulation 30-dozen cases. Fillers slightly deeper than standard fillers are also manufactured and are used to a limited extent in shipping extra large or extra long eggs.

Solid spruce-pulp fillers are in considerable favor, especially for packing eggs to be placed in cold storage, because, being odorless

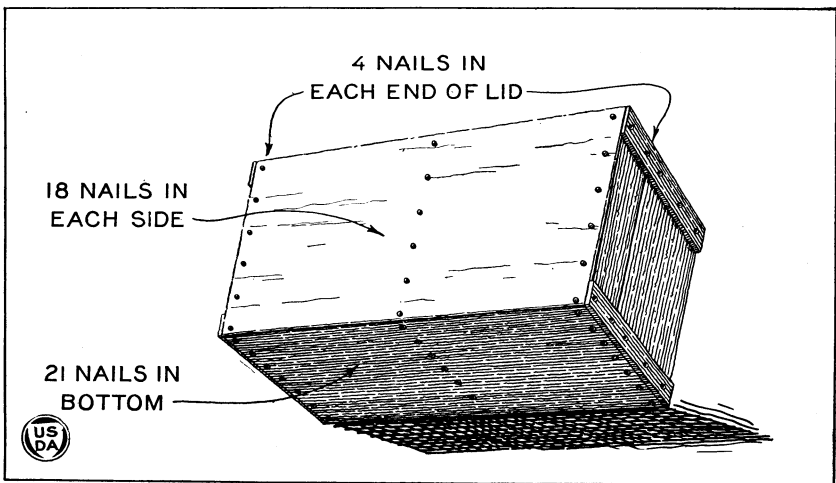


FIGURE 17.—A properly constructed egg case must be well nailed.

they help to prevent the development of the characteristic flavor of cold-storage eggs.

Strawboard, which formerly was the material used primarily in the manufacture of fillers and flats, is disappearing from use for the manufacture of egg packing materials. This material is not so desirable for such use because it develops an odor when damp, that seems to be readily absorbed by the eggs packed in it.

Fillers and flats used should be of good weight so as to be strong and protective. Fillers weak from use, although they appear to be in good condition, should not be used a second time when they are not in sufficiently good condition to protect the eggs properly. The flats in common use are cushion type flats, having depressions or recesses in which the ends of the eggs fit. These flats help to maintain the rigidity of the pack and, therefore, to protect the eggs against breakage. One of these flats is used between each two sets of fillers; they are also used at the top and bottom of the cases as a further protection to the eggs. Cushion flats, of the type which are now in common use, are generally packed 12 to the case, an extra flat being used on the top of the pack on each side of the case. Flats of this

type should weigh not less than  $1\frac{1}{4}$  ounces each, or 15 ounces per set of 12, and a set of 10 fillers should weigh not less than 35 ounces per set.

### PARCEL-POST PACKAGES

Parcel-post packages must be substantial in order to protect the eggs properly; at the same time they must be as light as possible to reduce postage costs. Special parcel-post packages are made in various sizes with capacities ranging from one dozen to several dozen eggs. Parcel-post packages which are not likely to be returned to the shipper are generally made of corrugated pasteboard because that material is inexpensive. If the packages are to be returned and re-used, more substantial types, often made of metal, are in common use (fig. 18). The ordinary 30-dozen case, when in good condition and properly packed, is also receivable by the postal authorities for the parcel-post shipment of eggs and is used under certain circumstances to a considerable extent.

### PACKING EGGS

The purpose of packing eggs is to furnish a convenient means of handling them, and also to prevent breakage during shipment. Too often egg producers pack their eggs somewhat carelessly. The postal requirements for mailing market eggs are as follows:

"Eggs will be accepted for mailing when packed in crates, boxes, baskets, or other suitable containers so constructed as properly to protect the contents. Such packages are transported outside of mail bags. All parcels containing eggs shall be plainly marked 'Eggs.' When necessary, they shall be marked 'This side up.'"

When eggs are mailed in special parcel-post packages each egg should be carefully packed by being wrapped in paper or by other means so that they will not shake or shift around in the package. Failure to do this is likely to result in breakage.

If second-hand 30-dozen cases are used for shipment of eggs to market they should be gone over thoroughly to see that they are in good condition and properly nailed.

Although different packing materials may be used in packing eggs in the case, the essential characteristic of any good pack is that it is tight so that the fillers will be held securely in place and will not shift over the flats.

The cup flats or cushion flats now in general use seem to be giving the best results in preventing egg breakage. Since the fillers fit down between the cups or raised places on the flats, they are prevented from sliding or shifting over the flats (fig. 19).

When long eggs are packed in extra-deep fillers to prevent end crush it is desirable to deepen the cases to relieve the pressure on the eggs. This can be accomplished by nailing 1-inch strips on top of the ends and centerboards. Eggs should always be packed small end down in the fillers as they carry better in transit and in storage when in that position.

After the packing of the case is completed, the top should be nailed on with four nails in each end of the case. Care must be taken not to nail the cover in the center. The packing will usually cause a slight bulge at the center of the top, which provides some elasticity

and is useful in helping to absorb shipping shocks. The case should be plainly labeled with the name and address of the person to whom it is shipped, the name and address of the shipper, the word "Eggs,"

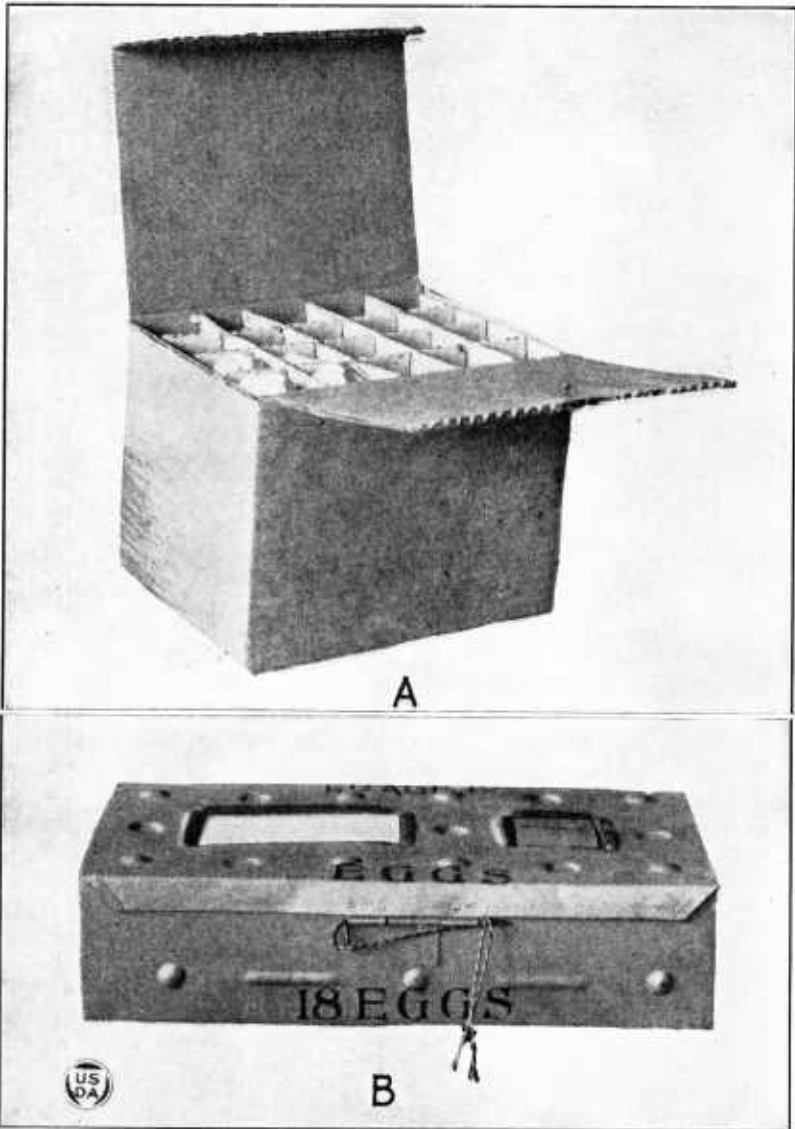


FIGURE 18.—Shipment of eggs by parcel post requires strong, light containers. A, corrugated pasteboard container; B, metal container.

and the statement of contents, "30 Dozen." Shipping tags or labels should be pasted or nailed on each end of the case rather than on the top, since they are protected on the ends by the end cleats.

At the packing house the cases are assembled from knocked-down stock on forms used for this purpose. The eggs are packed in the

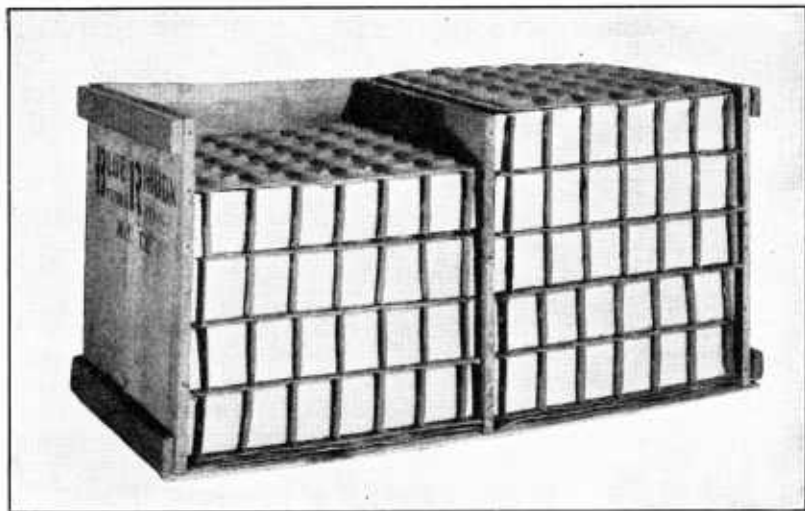


FIGURE 19.—An egg case packed with pulp fillers and cup flats makes an attractive package, protects the eggs well from breakage, and is a good package for cold storage because of the odorless character of the packing materials.

cases at the same time that they are candled and graded, being placed in the fillers by the candler.

## SHIPPING EGGS

### BY PARCEL POST

The parcel-post shipment of eggs to market is employed principally by producers who have built up a retail trade with consumers and make shipments at regular intervals in comparatively small lots. In emergencies, when express and freight shipping facilities are tied up, shipments of case lots of eggs may be made by parcel post to overcome the shipping difficulty.

The parcel-post shipment of market eggs is generally limited to shipments within the second zone, for it does not pay as a rule to ship eggs longer distances by this method because of the higher postage rates involved. Both because the weight of the container is greater per dozen eggs in a package of smaller capacity than in one of larger and because the postage charge for the initial pound is much greater than for each subsequent pound, it is more economical to ship eggs by parcel post in lots of more than one dozen.

The postage rate is the same to all points within the first and second zones, that is, within a radius of about 150 miles from the sending post office. The rate is 8 cents for the first pound and 1- $\frac{1}{2}$  cents for each additional pound. Local parcel-post rates are in force applying to parcels that do not go beyond the jurisdiction of the mailing office. These rates are lower than the rates for the first and second zones. Few parcel-post shipments of eggs, however, originate and end



within the jurisdiction of the same office. Consequently producers cannot often take advantage of these local rates.

Parcel-post shipments of eggs may be insured against loss or breakage like other merchandise. Whether it will pay to insure shipments will depend upon how successfully the shipper's consignments go through and how much protection it, therefore, seems desirable to provide in the way of insurance.

#### BY EXPRESS OR MOTORTRUCK

Many, perhaps most, of the shipments of eggs by express consist of small lots of from half a case to a few cases. There is no advantage in shipping two or more cases at once, as the rate on a case of eggs is figured at 53 pounds, regardless of the number of cases in the lot. Because it is more expensive to ship by this means than by freight, express is commonly employed for shipments involving comparatively short distances and is used in some sections primarily by producers. In shipping by express the requirements of the express companies must be carefully studied and complied with; otherwise claims for loss and damage will not be allowed. When it is possible to make express shipments either by day or night, it is preferable to ship at night, especially during hot weather, since the night temperatures are more favorable to maintaining the good quality of the eggs. Whether shipping by express or freight, shippers should attempt to guard against the eggs being left on the station platform for any considerable period of time, exposed to the hot sun, while waiting for a train. Such exposure will cause serious deterioration, particularly in fertile eggs, for the heat will cause development of the embryo. It is, therefore, extremely desirable to have the eggs placed under cover where they will be protected from both sun and rain.

Motortrucks are used extensively in shipping eggs in both small and large lots. Originally motortrucks were used primarily for the gathering of eggs from farms or for comparatively short movement of eggs to market. Under present conditions, trucks are used extensively in shipping large quantities of eggs for distances of a thousand miles or more. The use of refrigerated trucks has also been increased in an effort to protect the quality of the eggs during transit.

#### BY FREIGHT

Shipments of eggs by freight are usually of two kinds, the local pick-up freight and the through carlot shipment. The pick-up freight service takes the eggs from the small points in comparatively small lots and delivers them at the packing house or other concentration point. Most of this pick-up work is now being performed by truck. At the concentration point, after the eggs have been candled, graded, and repacked, they are ready for shipment to the terminal markets. Such shipment should be made whenever possible in carlots or truck lots in refrigerator cars or refrigerated trucks. The eggs should be well chilled before they are loaded into the cars or trucks. If eggs are shipped by refrigerator car, the car should be iced in warm weather, crushed ice without salt being used. It is desirable to reduce the interior temperature of the car below 40° F. before the loading of the eggs is begun.

The loading of a car should be accomplished as quickly as possible so that there will be a minimum rise in the interior temperature of the car through the open door. Sometimes a canvas with a slit in it is hung over the car door. This helps to retain the cool air in the car while allowing the passage of the loaders through the slit in the canvas. The egg cases are loaded in the cars in rows lengthwise of the car. The usual refrigerator car will accommodate 13 to 15 cases placed end to end lengthwise and 8 rows across. Generally the car is loaded not more than 4 layers deep.

Shifting of the load in the car is one of the most serious causes of egg breakage in carlot shipments. To prevent such shifting, care must be taken to load the cases tightly against one another and against the ice bunkers at the end of the car. If it is necessary or desirable to use any buffing at the ends of the car, this must be made tight between the cases and the bunker wall.

Wooden frames can be used for buffing. If used at the ends of the car, they are placed tight against the bunker wall, and the cases are packed tight against them. At the center of the car, similar wooden frames may be used in the space left between the ends of the cases. These frames can be made tight by driving additional wooden frames or braces between them to take up all slack. Floor or provision racks, with which refrigerator cars are commonly equipped by meat-packing companies, are generally used to brace egg shipments packed in such cars. (Fig. 20.)

Bracing frames, built in the form of wedges, are also placed at the center of the car. In using these to fill the space at the center of the load, one wedge-shaped frame is inverted so that its point is down. This is forced down as tightly as possible, and as the load gives in transit the frame keeps working lower and takes up the space gained, thus keeping the load tight. Braces of this nature are quite satisfactory.

If the car is loaded with an incomplete top layer, the cases of the next lower layer at the end and along the side of this incomplete layer should be raised 2 or 3 inches by means of frames set under them. The projecting top edges of these cases will engage the lower edges of the cases in the incomplete layer and in this way will hold them firmly in place and prevent shifting (fig. 20).

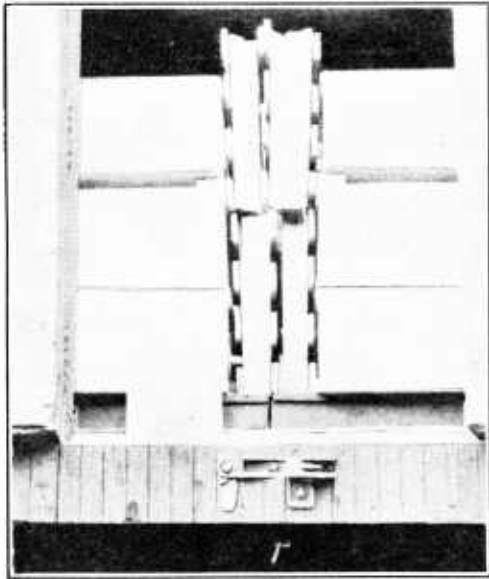


FIGURE 20.—Provision or floor racks in position between cases at center of car. Eight racks were used in this position in this car and were made absolutely tight by wedging pieces of board between them.

Four hundred cases are generally considered to be a standard carload of eggs, but this number may vary from slightly less than 400 to more than 600 cases. Refrigerator cars are re-iced on their way to market, as may be necessary or in accordance with the shipper's instructions, at icing stations maintained by the railroad companies. The insulation of the refrigerator car makes it possible to maintain a low temperature in the summer by using ice, and when the cars are used without ice in the winter it helps to protect the eggs from chilling or freezing during severe weather.

It is decidedly preferable to ship eggs to market in carloads unmixed with other produce. When it becomes necessary to ship a part of a carload of eggs, together with tubs of butter or with boxes of dressed poultry, it is necessary to brace the different parts of the load separately and very strongly to prevent damage to the eggs. When dressed poultry and eggs are shipped in the same car, it is best to load the packages of poultry at the ends of the car next to the ice bunkers and to load the cases of eggs at the center of the car and toward the top of the load. With this method of loading, the ice used in the bunkers may be salted to produce lower temperatures at the ends of the car and along the floor where the dressed poultry is located. If the positions of the produce in the car are reversed and the ice is salted, the eggs packed next to the bunkers may be frozen, while the poultry at the center of the car may not carry in as good condition because of an insufficiently low temperature at that point.

## PRESERVING EGGS

### HOME PRESERVATION

Various methods of preserving eggs for household use are employed to a limited extent. Chief among these are the water-glass method and the limewater method. Producers should make use of these methods of preservation only to carry a supply of the cheaper eggs produced in the spring or early summer for home use in the fall, so that more of the higher-priced eggs produced at that time can be sold. Water-glass or limewater eggs should never be sold in the usual market channels, but if for any reason the producer has occasion to sell any home-preserved eggs, they should be offered to the buyer as such.

### COLD STORAGE <sup>4</sup>

The principal and most satisfactory method of preserving eggs is cold storage. In packing eggs for cold storage, they should be carefully candled to remove low-quality eggs, cracks, and dirties. Leaving such eggs in the pack will increase losses during storage. Eggs intended for storage should be packed in new cases and in new, odorless packing materials.

Storage rooms for eggs must be utilized for this purpose exclusively. Other products cannot be satisfactorily stored with eggs because of the danger of imparting undesirable flavors or odors to the eggs. The temperature of an egg storage room should be maintained within a range of 29° to 31° F.; 30° is the temperature most commonly used. It

<sup>4</sup> For more detailed information on the cold storage of eggs, see U. S. Dept. of Agr. Cir. 73, **THE COLD STORAGE OF EGGS AND POULTRY**. For sale by Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents.

is important that the temperature be held as even as possible. The humidity at which eggs were previously held in cold storage ranged from about 82 to 85 percent. Under present-day conditions higher humidities are being used, up to 90 percent or more. Where this is being done, it is essential to insure a circulation of air in the storage room in order to prevent the development of mold. The egg cases are stacked one upon another, strips being placed between them to allow freer circulation of air. The room itself must be kept sweet and clean. It is customary to lime the floors and whitewash the walls after each storage season, in order to freshen and sweeten the room.

Some States have laws dealing with the sale of cold-storage eggs. Most of these have to do with the length of time that eggs may be kept in storage, the length of time they may be temporarily held in storage without being termed storage eggs, usually less than 30 days, the marking of the cases with the date on which they went into storage and the date when withdrawn, and the sale of cold-storage eggs only as such. Of late years there has been a swing toward the fresh-egg-law type of legislation instead of cold-storage legislation.

### PROCESSING

In recent years a method of treating eggs commonly referred to as "processing" or "shell treating" has been developed, and many market eggs are now so treated. This process consists of dipping the eggs for a few seconds in a bath of odorless, tasteless mineral oil, heated to a temperature sufficient to insure the maximum fluidity of the oil (usually about 130° F.). The oil closes the pores in the shell and thus prevents or lessens the evaporation of water from the egg. Eggs are sometimes processed and sold while still fresh, but most of the processed eggs are placed in cold storage. The process is not designed to replace cold storage but rather to improve the keeping quality of the eggs that are cold-stored.

A method has been developed of processing eggs in a vacuum and of releasing the vacuum in an atmosphere of carbon dioxide. This results in almost complete sealing of the pores of the shell and, therefore, reduces more completely the evaporation of water from the egg. The carbon dioxide drawn into the egg in releasing the vacuum appears to have some desirable effects in preserving the quality of the egg. This process has not as yet been used extensively in a commercial way.

### FREEZING

Among the receipts of eggs at the packing houses or concentration points, there are always a certain number that are cracked, dirty, or weak and that will not, therefore, suitably withstand shipment to market. To save these eggs, the process of breaking the eggs out of the shell and freezing them was developed, since the egg meats can be held frozen for a considerable time without appreciable deterioration.

The advantages and economies of using frozen eggs soon became apparent and caused a very rapid expansion in egg-breaking operations. The industry has become so important that cracked, dirty, or weak eggs no longer constitute the main source of supply. Egg-breaking plants are now located throughout the surplus-egg-producing sections of the country and have become large users of eggs from regu-

lar market supplies. These plants purchase eggs in direct competition with buyers of shell eggs for current use or for storage purposes.

The eggs to be frozen are first candled to eliminate inedible and unsuitable eggs. They are then placed in pails or other containers and carried to the breaking room, which should be well-lighted, air-conditioned, and maintained at a temperature of not over 65° F. This room must be built and equipped in such a manner that it can be kept clean and sanitary. It is desirable to hold the bacterial content of the frozen product to a minimum, and in order to accomplish this every precaution must be taken to prevent bacterial contamination of the good eggs by any bad eggs in the breaking stock.

As broken, each egg is dropped into a glass cup in which it can be inspected, smelled, and sometimes tasted, to see that it is suitable for freezing. As soon as two or three good eggs are accumulated in a cup, they are emptied into a larger container. If a bad egg is dropped into the cup, it is necessary to discard any good eggs which may be in the cup at that time. Any apparatus coming in contact with a bad egg is immediately removed to an adjoining room and thoroughly sterilized before being used again. The broken eggs as they accumulate, if they are to be prepared either as mixed egg or yolk, are dumped into a churn, in which they are agitated only enough to obtain a uniform mixture. The eggs may be prepared either as whole mixed eggs, or the yolks and whites may be frozen separately. The liquid product is placed in the final containers in which they are frozen, usually 30-pound cans. These cans are immediately taken to a sharp freezer, where a temperature preferably of minus 10° F. or lower is maintained and where they are frozen solid as quickly as possible. Frozen eggs are held and shipped in this condition and should not be thawed until they are ready for use. Frozen eggs are used principally by bakers, confectioners, and mayonnaise manufacturers.

### DRYING

To a limited extent, eggs are dried in the United States. In preparation for drying, the eggs are broken in the same way as in preparation for freezing. As in the case of frozen eggs, the eggs may be dried either as whole mixed eggs, egg whites, or egg yolks.

The customary manner of drying egg yolks or mixed eggs is to spray the liquid mixture into the top of a heated chamber. The fine spray dries quickly and falls to the bottom of the chamber as a powder. This powder is removed and further dried or otherwise processed so as to render it suitable for packing and storing.<sup>5</sup>

The common method of preparing dried albumen is to place the liquid albumen in tanks, in which it is subjected to treatment intended to hasten the break-down of the thick white. The treated white is then drawn into shallow pans which are placed in heated cabinets. They are left there until the egg white has dried. The white is then loosened from the pans, broken up in flakes or ground if desired, and packed in barrels or other containers for sale or storage.<sup>5</sup>

Dried-egg products are used for industrial purposes and also as constituents of ready-prepared flours, such as cake flours, pancake flours, and doughnut flours.

<sup>5</sup> THE EGG-DRYING INDUSTRY IN THE UNITED STATES. Poultry Section, Division of Marketing and Marketing Agreements, Agricultural Adjustment Administration, U. S. Department of Agriculture, 1938.

## FEDERAL-STATE EGG-GRADING SERVICE

With the cooperation of the various State departments of agriculture and the extension services of the State colleges, the United States Department of Agriculture offers an egg-grading service that is steadily becoming an important factor in egg marketing. Eggs may be marketed in accordance with Government grade, either loose or in cartons. When the latter method is used, the cartons containing eggs of the grade of U. S. Specials or AA grade, or U. S. Extras or A grade, are sealed with certificates showing the grade, the size, the date the eggs were graded, and the quality of the eggs (fig. 21). Cartons containing the U. S. Standard or Grade B eggs are not sealed with certificates of quality but are fastened with seals that simply show the grade and size of the eggs, and the date graded.

When the eggs are sold loose, that is, without cartons, cross strips of 2-inch gum tape are stapled in the center over the top of each 15

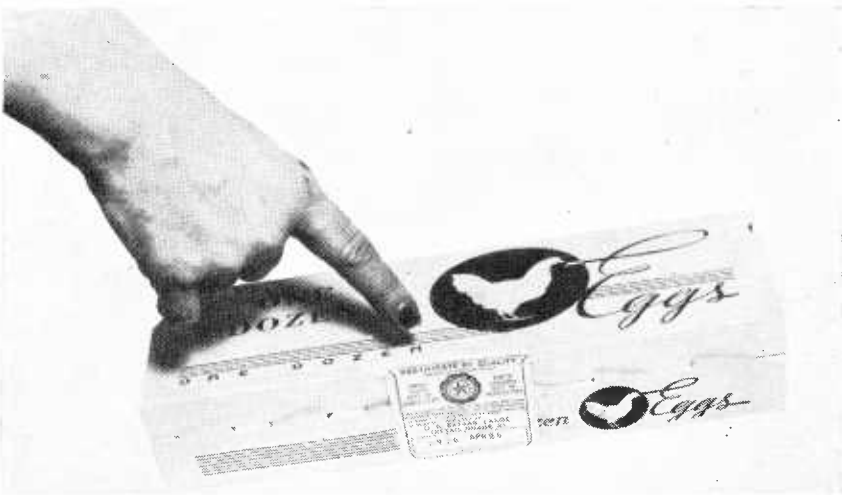


FIGURE 21.—The certificate that seals the carton not only shows the grade and size of the eggs, but also the date the eggs were graded.

dozen eggs. The official stamp of the Federal-State grader, showing grade and date, is then stamped at the intersection of the tapes. These stamps show the grade and date graded, and usually a rubber stamp showing the size and color of the eggs is used on the end of the cases. Loose eggs are marketed mostly by wholesalers and jobbers.

Carton eggs are usually sold direct to retail stores. The service is carried on through the cooperation of the State agencies, which train individual graders and have direct supervision of all matters pertaining to the grading work. The graders are employed or licensed by the United States Department of Agriculture on the recommendation of the State supervisors. This grading work is largely self-supporting through charges made for the service, although in many States State funds are used in getting the service started.

At the present time about one-half of the States are cooperating with the Federal Government, and the service is now available in

practically all the important egg-producing States. After the cooperative agreement between the Federal Government and the State cooperating agency has been signed and the State supervisor instructed and licensed, the State or the Federal Government in turn signs an agreement with the firms or cooperative associations that desire the service. Employees are trained, suitable candling facilities are provided, and licensed men who do the actual grading are placed at the plant. The salaries of these men are paid by the plant operator, who also pays a slight charge in addition, to help defray the expenses of the supervisor.

Probably the most pronounced success of this type of grading service has been the marketing of eggs under Federal-State certificates of



FIGURE 22.—Consumers look at the dates carefully in order to make sure the eggs are of recent candling. Note that the eggs in this retail package are kept in the ice box to preserve their quality.

quality. Consumers in most cities have shown a decided preference for eggs marked with the true quality and size and have come to look upon the dated grading certificate with a degree of confidence not always extended to eggs marked simply with a private brand (fig. 22).

During the calendar year 1939 more than 1,333,000 cases of eggs were graded by licensed Federal and State graders. Of this amount, 217,818 cases were marketed under certificates of quality and 81,265 under Grade B seals.

Because of the satisfaction this type of grading has given producers, distributors, retailers, and consumers it is expected that considerable expansion in this service will develop in the near future.

**POINTS FOR THE PRODUCER TO REMEMBER IN MARKETING EGGS**

Keep strong, healthy, vigorous hens and care for them properly.

Keep plenty of clean litter on the floor.

Provide plenty of clean nests for the laying hens; one nest for every six hens.

Keep hens confined to the house when the yards are muddy.

Confine broody hens.

Gather eggs at least twice a day in cool weather and three times a day in hot weather. Have hands clean.

Keep the eggs in a cool, fairly moist place.

Remove the animal heat from the eggs before they are packed in the cases. A temperature between 45° and 60° F. is best.

Produce infertile eggs after the hatching season. Incubation starts at 68° F.

Sort out the cracked, dirty, small, and very large eggs for home use or pack the large eggs separately.

Never wash eggs unless they are to be used immediately by local trade. Any dirty eggs should be cleaned with wire brushes, sandpaper, steel wool, or other dry-cleaning material.

Market eggs frequently—at least once a week in winter and preferably three times a week in summer.

Know the preferences of your market and strive to meet them.

Grade your eggs for uniformity in size, shape, and color.

Always pack the eggs so that they will rest on the pointed end, with the large end up. This is very important.

Know the shipping requirements of express, truck, and railroad companies if you use their services.

Use only sound, strong, standard packages, and pack the eggs properly in clean packing materials. Never use newspapers or other printed material.

Remember that quality is essential for best prices.

If you are selling through a satisfactory agency with which you have established a reputation for high quality, be very sure that you have obtained a better outlet before you make a change.

If you sell to local dealers, insist that the eggs be purchased on a quality or graded basis.



